REMARKS

Claims 1-6, 8 and 9 are pending in the present application. Claim 7 has been canceled. The specification and claims have been amended, and no new matter has been added.

Claim 9 has been rejected under 35 U.S.C. §112, first paragraph, as allegedly failing to comply with the enablement requirement. The Office Action asserts that claim 9 is directed to a data processing system comprising means for carrying out the steps of the method according to claim 1. However, the means for carrying out each step of the method have not been defined in either the claim or the specification. Applicants respectfully traverse this assertion. At page 5, line 22 through page 6, line 11, applicants describe a computer program for estimation of the process variables according to the invention and further recite a data processing system for the estimation of the process variables. The data processing system comprises a means for carrying out the steps of the method in which the data processing system is an apparatus comprising a data processor, a memory coupled to the processor and computer program code means stored in said memory, where said computer program code means, when executed by the processor, causes the method according to the invention to be executed. Applicants respectfully assert that one of ordinary skill in the art would understand that upon loading a computer program is capable of executing the steps recited in independent claim 1 with know-how to place the computer program on a computer and operate the computer. Therefore, the rejection of claim 9 under 35 U.S.C. §112, first paragraph, should be withdrawn.

Claims 1-9 have also been rejected under 35 U.S.C. §112, second paragraph, as being indefinite. For instance, the limitation of measuring values for measured variables **u** has been rejected because the Examiner believes that one of ordinary skill in the art of process state estimation would not know what is meant by measured variables. However, when reviewing the whole claim limitation of measuring values for measured variables **u**, one of ordinary skill in the art would understand that the measured variables **u** refers to the values that are measured and that the variables are measured. However, in order to expedite prosecution, this feature has been amended and therefore the rejection of claim 1 should be withdrawn. Also, claim 1 has been rejected as lacking antecedent basis for the limitation of "the complete state." This limitation has also been amended. In addition, claim 7 has been canceled. Applicants respectfully submit that the claims presently overcome the rejection under 35 U.S.C. §112, second paragraph, for the above reasons and request that the rejection be withdrawn.

Claims 1-9 have been rejected under 35 U.S.C. §101 as being directed to non-statutory subject matter. Claim 1 has been rejected because the claim lacks the tangible, concrete result in that the method results in a computed estimate of the state. No action is performed with the estimated state once it is computed. Claim 1 has been amended to recite presenting the estimate to a user. Support for this can be found at least at page 5, line 22 through page 6, line 11 and also at page 13, line 11 through page 14, line 5. Therefore, claims 1-6 now recite a tangible, concrete result in which the method results are used. As for claims 8 and 9, these claims have been further amended to recite computer readable mediums that cause a computer to execute the steps embodied on the computer program embodied on a

computer readable medium and the data processing system now recites the steps which are performed by the data processing system.

Claims 1-3 and 7 have been rejected under 35 U.S.C. §102(b) as being anticipated by the doctoral dissertation of Bohn. Applicants respectfully traverse.

In a description of State Augmented Extended Kalman Filters in the background section of applicants' specification at page 3, Applicants discuss a State Augmented Extended Kalman Filter that uses the vectors $k_0 \ldots k_3$ having polynomial coefficients that are estimated, and that the complete estimation of a physical property of the process such as the efficiency is done according to the block diagram of Figure 1. The coefficients $k_0 \ldots k_3$ lack physical meaning. Their values are very sensitive to variation in the data and are not adequate for extrapolation to conditions other than the ones they are generated from.

The system as described in the Bohn dissertation is similar to this prior art system discussed with respect to applicants' Figure 1. For instance, at page 32, second full paragraph, Bohn states that the approaches in this chapter can treat both the estimation of "optimal" noise covariance matrices (or the optimal fixed filtered gain) in system parameters in the same framework. According to Bohn, the augmented state denoted **p** is a parameter vector comprising "additional quantities such as system parameters, disturbances or unknown input signals" (page 33, first paragraph of chapter 4.2). On page xii, the definition of **p** recites a "parameter vector of a dynamic" system. Bohn, like the prior art, discusses fixed values or input signals that do not represent physical properties of the process. Nor does Bohn suggest that such parameters are physical process values.

For instance, in the "T3-Tank System" in chapter 7 of Bohn, the system parameter vector **p** consists of the parameters that determine various flows or gains of the pumps. The cursive parameter estimation applied to this system in order to identify the parameters converges to a steady state value (Figure 7.3) of the parameters. The constant and previously unknown system parameter values are independent of the state vector **x** (i.e., the water levels in the three tanks) that may continue to vary indefinitely. In contrast, a physical process property as described in the present application and recited in independent claims 1, 8 and 9, would be the total quantity of water in the three tanks or a derivative thereof. In addition, the system recited in chapter 7 utilizes the extended Kalman filter and not the State Augmented Extended Kalman Filter as recited in applicants' independent claims.

In contrast, according to Applicants' independent claims 1, 8 and 9, the augmented state **p** includes physical properties of the process as opposed to system parameters as in the standard state augmented extended Kalman filter. Likewise, the physical process properties being representable by a function of the state vector **x** indicates that such process properties are dynamic quantities, again unlike the "system parameters" of the standard State Augmented Extended Kalman Filter.

Accordingly, for the above reasons, the rejection of claims 1-3 should be withdrawn.

Claim 4 was rejected under 35 U.S.C. §103(a) as being unpatentable over the Bohn dissertation in view of U.S. Patent No. 6,741,955 to Rutherford. As stated by the Examiner, the Rutherford patent discloses a method for estimating mass flow rate of a turbomachine using an extended Kalman filter. However, as evidenced by Figures 4, 5 and 6 and the text associated therewith, Rutherford relies upon

determining leak rate based on model parameters and discusses the determination of model parameters, whereas in contrast, independent claim 1 recites wherein the vector of variables **p** represents one or more varying physical properties of the process and also computing an estimate of a state of the physical process including the augmented state according to an SAEKF algorithm.

Neither the Bohn dissertation nor the Rutherford patent discloses or suggests the feature of the vector variables **p** represents one or more varying physical properties of the process and is representable by a function of the state vector **x** as recited in independent claim 1. Therefore, the Rutherford patent does not overcome the deficiencies of the Bohn dissertation. The Rutherford patent and the Bohn dissertation, either in combination or individually, do not disclose or suggest all of the features recited in applicants' independent claim 1. Accordingly, the rejection of claim 4 should be withdrawn.

As for dependent claim 5, it was rejected under 35 U.S.C. §103(a) as being unpatentable over the Bohn dissertation in view of the IEEE article to Parlos.

In making the rejection, the Examiner states the motivation for doing so would have been to give Bohn's teachings a real-world application by estimating heat transfer parameters for a steam generator in reference to Parlos page 1412, column 2, first bullet point. However, from a review of the abstract it appears that Parlos uses recurrent neural networks to provide adaptive state filtering. For instance, at line 9 of the abstract, it states the algorithms presented are based on the two-step prediction-update approach of the Kalman filter. However, unlike the Kalman filter and its extensions, the proposed algorithms make minimal assumptions regarding the underlying non-linear dynamics and their noise statistics. The abstract further

goes on to disclose that at line 17 of the abstract, furthermore, extended Kalman filters (EKFs) are developed and compared to the filter algorithms proposed. For one of the case studies, the EKF converges but results in higher state estimation errors than the equivalent neural filters. For another, more complex case study with unknown system dynamics and noise statistics, the developed EKFs do not converge. This appears to be a teaching away of using the extended Kalman filters in preference to the recurrent neural network filters developed in the article. In fact, bullet point 2 cited by the Examiner, when read in context, clearly states that the performance of the developed neural filters is extensively tested and compared to the EKF, demonstrating the resulting improvements in performance in broad applicability. Clearly this is a teaching away of using the Kalman filter for developing state filters. Therefore, the rejection of claim 5 should be withdrawn for at least the above reasons. Furthermore, the Parlos article does not overcome the deficiencies of the Bohn dissertation. The Parlos article and the Bohn dissertation, either in combination or individually, do not disclose or suggest all of the features recited in applicants' independent claim 1.

As for claim 6, it was rejected under 35 U.S.C. §103(a) as being unpatentable over the Bohn dissertation in view of the IEEE article by Draper. The Draper article, as best understood by Applicants, discloses modeling a spring function and backlash using an augmented extended Kalman filter, as disclosed at page 442, first full paragraph, and a learning augmented extended Kalman filter (LAEKF) as disclosed at page 439, column 1 and 2 including Figure 1.

The augmented extended Kalman Filter and learning augmented extended Kalman filter as disclosed in the Draper article are different from the state

augmented extended Kalman filter as used in Applicants' invention. For example, the system described in Figure 1 and page 441 and 442 of the Draper article illustrates a blending system that is used to further train the learning system. The Draper article does not disclose or suggest a vector of variables that represents one of more varying physical properties of the physical process and is representable by a function of the state vector **x**, nor does the Draper article disclose or suggest the steps of measuring values of an input vector u, incorporating the vector of variables **p** as an augmented state in the state augmented extended Kalman filter, and computing an estimate of the complete state including the augmented state according to a state augmented extended Kalman filter algorithm as recited in independent claim 1. Therefore, the Draper article does not overcome the deficiencies of the Bohn dissertation. The Draper article and the Bohn dissertation, either in combination or individually, do not disclose or suggest all of the features recited in applicants' independent claim 1. Accordingly, the rejection of claim 6 should be withdrawn.

Applicants respectfully submit that claims 1-6, 8 and 9 are in condition for allowance, and notification to that effect is respectfully requested.

Should the Examiner require any further information or believes that a personal interview would expedite prosecution of the above application, she is requested to contact the undersigned.

Respectfully submitted,

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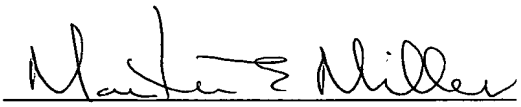
Date: December 7, 2006 By: 

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